



ORIGINAL ARTICLE

On Messages

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In this paper, I discuss the concept of a 'message' as applied to the different forms of communication: between man and machine, between machine and machine and between man and man. The term 'message' can refer to a relatively simple cause and effect interaction. An example is the transmission of a mechanical signal that, when decoded by a receiving system, triggers a standard response. It can also refer to the much more subtle and complex case where recipients construct meanings on the basis of the messages they receive. I contend that it is only in this latter case that we can properly refer to the interaction as a 'conversation'. In the paper I present cybernetic models of these two usages. I relate the abstract discussion to current developments concerned with man-machine interaction and the development of a 'global brain'.

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1. Introduction.

“Society can only be understood through a study of the messages and the communication facilities which belong to it; and that in the future development of the messages and communication facilities, messages between man and machines, between machines and man, and between machine and machine, are destined to play an ever-increasing part” (Norbert Wiener, 1950).

In this paper, I discuss the concept of 'message' as applied to these different forms of communication: between man and machine, between machine and machine and between man and man. (As intended by Wiener, 'man' is used as general noun that includes all human beings; later in the paper, to accord with contemporary usage, I use the term 'human'). As Ludwig Wittgenstein (1953) reminds us, rather than ask what a word means we should look to see how it is used. The term 'message' can refer to a relatively simple cause and effect interaction. An example is the transmission of a mechanical signal, that when decoded by a receiving system, triggers a standard response. It can also refer to the much more subtle and complex case where recipients construct meanings on the basis of the messages they receive. I contend that it is only in this latter case that we can properly refer to the interaction as a 'conversation'. In the paper I present cybernetic models of these two usages, messages as codes and messages as constituents of conversations¹. I go on to discuss the relevance of the code/conversation distinction for the different cases when senders and recipients are human beings or machines. The coding model is presented in section 2. It should be familiar to

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most sociocyberneticians. It is the model developed by Claude Shannon and Warren Weaver (Shannon and Weaver, 1949).

The conversation model is presented in section 3. It is taken from the cybernetic conversation theory of Gordon Pask (Pask, 1975, 1976)². This model may not be familiar to many sociocyberneticians, so I present it in some detail. In section 4, I pay particular attention to man-machine interaction, noting there are observer-dependent contexts in which such interactions may be usefully considered to be conversational in form and for which the machine ‘participant’ may be explicitly designed to be a surrogate for a human conversational partner. In section 5, I relate the abstract discussion to current developments, some examples of which are: algorithms for search and retrieval and other data mining processes, the development of recommender systems and the emergence of the constituents of what some now refer to as a ‘global brain’. In section 6, there are some concluding comments.

2. Communication as coding

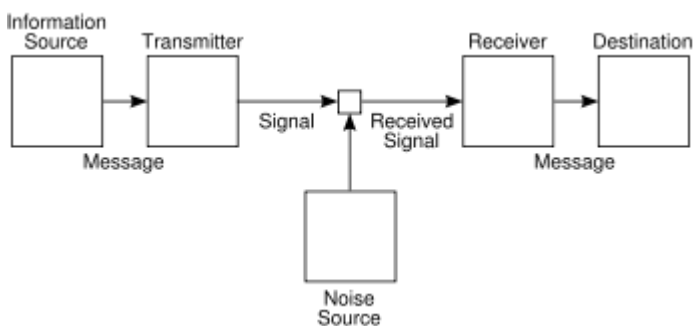


Figure 1. The Shannon and Weaver model of communication.

The Shannon and Weaver model of communication is shown in figure 1. It is what lies at the heart of their so-called ‘information theory’, which is concerned with measuring the capacity of channels to transmit messages when the channels may be subject to ‘noise’ that degrades the messages and measure of how much ‘information’ is contained in particular messages. I have put the word ‘information’ in quotation marks because I, like many other scholars, find the use of the word to be problematic and liable to create semantic confusion. Instead of talking about ‘information transmission’ in the Shannon and Weaver model, I believe it would be more appropriate to talk of ‘data transmission’ since the concern is only with the ‘surprise-value’ of messages, where a message is a sequence of physical events distinguished by an external observer that are considered to represent possible symbolic entities (such as noughts and ones, alphanumeric characters, dots and dashes) taken from a finite set and combined according to set rules. The semantics of messages (‘meanings’) are not considered. In Gregory Bateson’s terms, each event is a ‘difference’ in so far as it is indeed different from other members of the set. Shannon and Weaver’s model is thus concerned with how well these differences can be transmitted without degradation.

Critics of this usage of the term ‘information’ point out that the events (the data) are only considered as informative insofar as, from the perspective of an external observer, their reception brings about a relevant (significant, meaningful) change in the receiving system, i.e., there is some acknowledged pragmatic consequence³. As Bateson puts it, “Information is a difference that makes a difference”. In similar spirit, Jerzi Konorski (1962) says, “Information cannot be separated from its utilisation.” Classic examples of differences that make differences are the feedback signals in a control mechanism, such as a thermostat, which indicate whether or not a particular goal has been achieved or maintained.

3. Communication as conversation

In contrast to the simple mechanical transmitter-receiver model of the last section, Pask’s conversation model invokes participants in the conversation, at least one of which must be an autopoietic, self-organising system, that is, a system which, in response to perturbations and in the context of its own purposive interaction with its environmental niche, constructs a meaningful reality for itself, i.e., it becomes ‘in-formed’ of its world. The important thing to appreciate is that, although the events that make up the conversation between the participants may appear to have code-like properties when viewed from an external observer’s perspective, this is only ever partially so. Events provoke participants to construct meanings. As Heinz von Foerster puts it, “It is the receiver of a message who decides its meaning.”⁴ Thus Pask’s conversation theory is concerned with the pragmatics of human communication and is consonant with the theories of Gregory Bateson and others (Bateson, 1972; Watzlawick et al, 1968).

Pask’s model for a conversation (‘the skeleton of a conversation’) between two participants is shown in figure 2. In the model, one participant is deemed to be the teacher, the other the learner. The figure represents what Pask (1975) refers to as a ‘strict conversation’: one in which the topic to be discussed has been agreed and where one participant the learner has agreed to learn about the topic as expounded (explicated or professed) by the teacher. This limited focus of the model is helpful as a starting point for our discussion. As conversations evolve, participants may change role and new topics for conversation may be invoked and agreed. The conversation itself may become a topic for conversation. Rather than refer to messages, Pask prefers to refer to ‘provocations’. At a very general level, every provocation can be considered to be a command or invitation to the other to be informed of a thesis. For example, a question can be viewed as a command (or invitation) to the other to supply requested information.

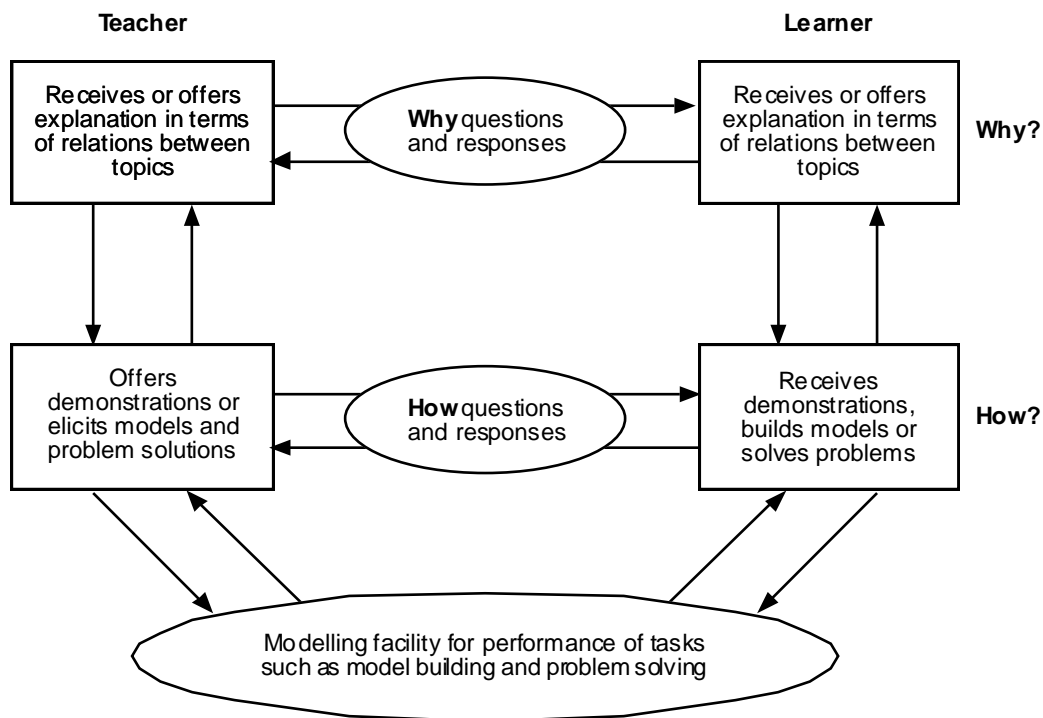


Figure 2. The “skeleton of a conversation” (after Pask).

Figure 2 shows a snapshot view of two participants in conversation about a topic. The horizontal connections represent the provocative exchanges. Pask argues that all such exchanges have, as a minimum, two logical levels. In the figure these are shown as the two levels: ‘how’ and ‘why’. The ‘how’ level is concerned with descriptions of how to “do” a topic: how to recognise it, construct it, maintain it and so on; the ‘why’ level is concerned with explaining or justifying what a topic means in

terms of other topics. These exchanges are 'provocative' in that they serve to provoke participants to construct understandings of each other's conceptions and (possibly) misconceptions of topics and the relations between them. This is the essential aspect that makes conversation theory constructivist and dialogical in approach and clearly distinguishes it from other approaches that see teaching as the transmission of knowledge from teacher to learner.

The vertical connections represent causal connections with feedback, a hierarchy of cognitive processes that control or produce other cognitive processes. At the lowest level in the control hierarchy there is a canonical world, a 'universe of discourse' or 'modelling facility' where the teacher (or computer-based surrogate, as incorporated in CASTE, as described below) may instantiate or exemplify the topic by providing non-verbal demonstrations. Typically, such demonstrations are accompanied by expository narrative about 'how' and 'why', the provocative interactions of questions and answers referred to above. Note that the form of what constitutes a canonical world for construction and demonstration may itself be a topic for negotiation and agreement.

Consider, for example, a set of well-defined topics in chemistry. A teacher may:

- Model, demonstrate or exemplify certain processes or events;
- offer explanations of why certain processes take place;
- request that a learner teaches back his or her conceptions of why certain things happen;
- offer verbal accounts of how to bring about certain events;
- ask a learner to provide such an account; and
- ask a learner to carry out experiments or other practical procedures pertaining to particular events or processes.

A learner may:

- request explanations of why;
- request accounts of how;
- request models, demonstrations and examples ;
- offer explanations of why for commentary;
- offer explanations of how for commentary; and
- carry out experiments and practical activities.

In turn, the learner uses the modelling facility to solve problems and carry out tasks set. He or she may also provide narrative commentary about 'how' and 'why'. In a computer-based environment these may be elicited using computer aided assessment tools with a variety of different question styles. The distinction between 'how' and 'why' allows for a formal definition of what it means to understand a topic. In CT, understanding a topic means that the learner can 'teachback' the topic by providing both non-verbal demonstrations and verbal explanations of 'how' and 'why'. Pask notes that conversations may have many levels coordination above the why level: levels at which conceptual justifications are themselves justified and where there is 'commentary about commentary'. Harri-Augstein and Thomas (1991) make this notion central in their work on self-

organised learning, where the emphasis is on helping students 'learn to learn'. In brief, they propose that a 'full learning conversation' has three main components:

- (1) conversation about the how and why of a topic, as in the basic Pask skeleton of a conversation model;
- (2) conversation about the how of learning (for example, discussing study skills and reflecting on experiences as a learner); and
- (3) conversation about purposes, the why of learning, where the emphasis is on encouraging personal autonomy and accepting responsibility for one's own learning.

Everyday conversations only approximate the form of the 'strict conversation' shown in figure 2. Participants do not regularly check their understandings by teachback, nor do they coherently justify, model, demonstrate or exemplify the topics they are discussing. As I discuss further below, Ranulph Glanville (1993) has helped bring the skeleton of a conversation to life (to put flesh on its bones) and allow us to see how conversation theory captures the essence of what is happening when humans converse. Glanville emphasises the creativity and joyfulness that can, indeed should under ideal circumstances, accompany human conversation.

It would be remiss not to mention another facet of Pask's theorising. This is his detailed account of 'conceptualisation'⁵, the processes whereby new concepts come into being amidst the flux of the ongoing evolutionary dynamics of the self-reproducing system of concepts that constitute a psychological individual⁶. Pask's insight, inspired by the work of Lev Vygotsky (1962) is to realise that these processes are conversational in form. There is an inner dialogue in which a learner constructs, contemplates and contrasts different perspectives of a topic: her own, her teacher's, her peers or other authoritative sources. It is this inner dialogue that permits the effective learner to act as her own teacher. With this insight, Pask offers a unifying perspective on individual and social psychologies: a psychological individual (an 'I' embodied in one body) is conversational in form; a conversation (a 'we' embodied in more than one body) has the form of a psychological individual. Both are self-reproducing systems of concepts. Both are examples of what Scott (2014) refer to as 'psychosocial unities'.

Glanville sets out a scheme that elaborates "the qualities necessary so that a conversation may function". Here, I outline Glanville's scheme with some additional commentaries of my own.

Glanville refers to two sets of requirements for a conversation to function, which he refers to as 'operational requirements' and 'inspirational requirements'. By the former he means those aspects of the interaction process which must be present for the interaction to be considered to be a 'conversation', rather than a more arbitrary or limited encounter between participants such as a simple exchange of greetings, goods or physical contacts. One could perhaps also refer to them as 'functional' or 'processual' requirements. Inspirational requirements concern the attitudes and motivations that it is necessary for participants to bring to the conversation for it to flourish as a mutually creative and uplifting encounter. Both sorts of requirements take the form of tacit, sometimes explicit, reciprocal expectations and are akin to the 'cooperative principle' of Paul Grice that states, "Make your contribution such as it is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged" (Grice, 1975, p. 45)⁷. A key difference is that Glanville's requirements are concerned with the whole of the encounter that is the conversation, whereas Grice is concerned at a more micro-level with 'good' (effective) practice

with respect to individual speech acts and responses and the implications ('conversational implicatures') that can be drawn from them on the assumption that the cooperation principle is being adhered to.

Glanville's operational requirements⁸

1. A willingness to take part in a conversation about some topic. At least two participants are needed.
2. The topic around which the conversation takes place. The topic is negotiable and may change. There is an ever present background topic, the reflexive topic, "What shall we talk about?"
3. The existence of different understandings of the topic in all participants. Without these differences, there would be no need for conversation.
4. Acts that are intended to present the form of these understandings so that the other participants can construct their own understandings of these understandings together with acts that are intended to request the presentation of understandings (questions).
5. An ability to compare understandings: my understanding with my understanding of your understanding of my understanding and, vice versa, your understanding with your understanding of my understanding of your understanding. (In Pask's terms, this is part of the inner dialogue that informs conceptualisation.)
6. A logical structure of three co-located and contemporaneous levels: the level of the conversation, the subordinate level of the topic being addressed, and the metalevel of error correction and topic modification (critique and evaluation of the conversation's progress).
7. An ability to monitor what is going on and to correct for incompatibilities between understandings by switching levels, i.e.:
 - a. switching to a meta-conversation in which misunderstandings (temporarily) become the topic of the conversation
 - b. switching back to the topic of the conversation itself. (Glanville notes that these switchings can occur recursively: misunderstandings may be misunderstood and require further error correction.)
8. A way of initiating and terminating the conversation. (Glanville notes that in Pask's CT, the occurrence of an understanding punctuates the conversation into discrete, possibly concurrent, episodes. In real life conversations, participants may terminate a conversation when mutual understanding is acknowledged, when there is an agreement to disagree or as a matter of whim. Of course, the conversation may be taken up again on a future occasion. Glanville further notes that in real life conversations, confirmation of mutual understandings is not expected for each and every communicative act. This is especially the case when participants believe that they already share many understandings. However, there is a price to pay for these shortcuts: the inadvertent pathologies of communication that occur when everyone thinks everyone else knows what is going on, when, in fact, they do not⁹.

Glanville's inspirational requirements

1. Recognition that the other has a different understanding.

2. Respect for this difference and the owner of the difference. Respect allows the participants to form their own individuality. Respect allows that I am not you.
3. Willingness to listen and hear the other.
4. Willingness to construct my own understanding of what the other presents to me as her understanding.
5. Willingness not to try to force my view on the other, i.e., not to exploit power relationships due to differences in social position.
6. An open mind, i.e., being prepared to give space to the other and to negotiate.
7. To regard surprises in the conversation not as threats but as being beneficial as opportunities to learn.
8. Willingness to change, develop, improve, i.e., to learn.
9. To recognise that what arises in conversation is not the property of a particular individual participant but rather is jointly owned. This is to recognise that the conversation has a life of its own. (In Pask's terms, the conversation itself is a p-individual),
10. A willingness to go with conversation, to expect and allow for the unexpected.

Glanville argues that underlying these inspirational requirements are certain qualities that are associated with being a good and decent human being. These qualities are generosity, respect, honesty and a sense of drama; openness, imagination, acting on opportunities and wit. He ascribes these qualities to his mentor, Gordon Pask, and goes on to say of his encounters with him:

“This is magic. Magic not as trickery or deceit, but magic in the unravelling enjoyment of mysteries and the growing and maintaining of wonder a deep understanding of the miracle of our existing in our differing worlds and of their coming together in conversation through their beginnings and ends. Of the poetic nature of our existence and of the unity of the void, the nothingness in and through which we dwell. And the love that is necessary that we can converse and interact with those others with whom we dwell, fairly and doing justice to them and to ourselves” (Glanville, 2001, p. 667).

4. Human-machine interaction

CT grew from Pask's interests in adaptive teaching systems¹⁰. He argued that the interaction between a learner and a teaching machine has the form of a conversation. The machine, as teacher, poses problems to the learner and learns about the learner in order to optimise learning. The learner attempts to solve problems and requests help and support. Pask noted that for human-machine interaction in general there are many contexts in which such interactions may be usefully considered to be conversational in form and for which the machine 'participant' may be explicitly designed to be a surrogate for a human conversational partner. Conversation theory provides the logic for how to design an effective machine participant¹¹. Provocations need to take place via a suitable interface according to agreed semantic and syntactic rules. The pragmatics are provided by the role that the human participant has elected to play (learner, designer, game player) and are complemented by the affordances provided by the machine. In current parlance and practice, the latter is likely to be a computer based application running various 'algorithms' with access to the Internet (see below).

An early example is Author (1973) CASTE (Course Assembly System and Tutorial Environment). CASTE was developed in response to the need to provide learners with a description of a body of

subject matter so that there could be conversation between a computer-based tutorial system and the learner about topics being studied and about possible learning strategies. Whalley (1995), with approval, refers to CASTE as a system that “provided both a ‘virtual’ environment for the student and a system to facilitate learning conversations about it” and “clearly worked as an integrated whole”. Using the conversational features of CASTE, system and learner agreed what was likely to be an effective learning strategy and established an associated ‘learning contract’. This latter typically included the agreement that progress was contingent on the student successfully ‘teaching back’ what he or she had learned so far. Using these contractual constraints, effective learning to ‘mastery’ level (Block, ed., 1971) was regularly achieved.

The main features of CASTE are shown in figure 3.

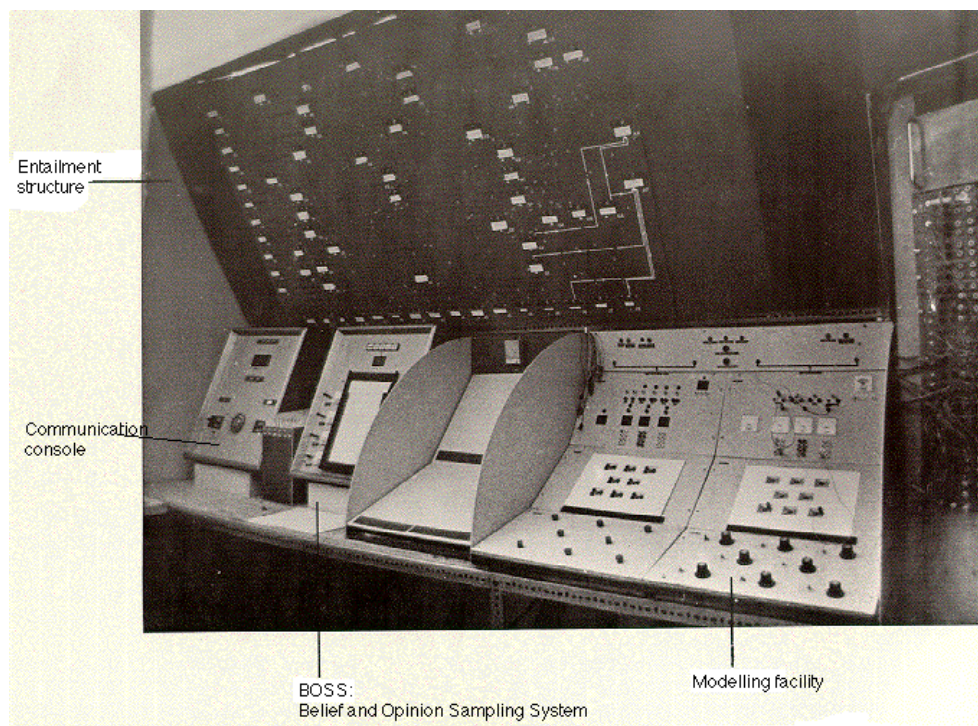


Figure 3. CASTE, main features

Subsequent to CASTE, Pask and associates developed ‘Thoughtsticker’, a sophisticated suite of programs that support knowledge elicitation and course design processes. (See Pangaro, 2001, for a very accessible account of Thoughtsticker functions).

The key operation of Thoughtsticker is that of recommending novel perspectives and associated expository narratives. This is achieved by, first of all, eliciting from the user a ‘knowledge fragment’, a particular perspective and narrative form, and representing it as an entailment structure. Then, as a purely syntactic operation, Thoughtsticker adds links intended to make the fragment locally and globally cyclic. Novel perspectives are then generated by a ‘pruning’ operation, which removes redundant links. New perspectives are presented to the user as entailment structures that show putative alternative ways that she might choose to expound the subject matter. The novel perspectives may provoke new insights and understandings. It is up to the user to accept, reject or modify the proposals.

In the larger domain of the Internet and hypertext knowledge archives, work inspired

by conversation theory has been carried out on self-organising ‘learning webs’ where “Learning algorithms ... adapt the link strengths, based on the frequency with which links are selected by hypertext users.. to make the World-Wide Web more intelligent, allowing it to self-organize and support inferences”

(Heylighen, 2001) and on 'recommendation systems' for "An extended process of information retrieval in distributed information systems" where "The knowledge stored in distributed information resources adapts to the evolving semantic expectations of their users as these select the information they desire in conversation with the information resources" (Rocha, 2001). A recommendation system is a generalisation of the Thoughtsticker course design tool. The system models the behaviour of the user of a set of distributed information resources, makes inferences about the predications she is using to give meaning to the information resources and makes recommendations to the user based on those inferences. The user then may or may not validate those inferences by her acceptance or not of the recommendations. Thus a 'hermeneutic circle' is set up, where user and system may converge towards a mutually shared set of meanings^{1 2}.

5. Some current developments

In 1993, inspired by the ideas of Pask, Vannebar Bush (1945) and Ted Nelson (1990), I set out the vision for a multimedia archive to support open learning, in which 'front end' systems interacted conversationally with learners and teachers (see figure 3). I later appreciated that the model I had constructed could be generalised to apply to the Internet, the World Wide Web, 'knowledge' archives such as Wikipedia, and the current developments that are seen as steps in the construction of a 'global brain', as first envisaged by H.G. Wells (1938).^{1 3}

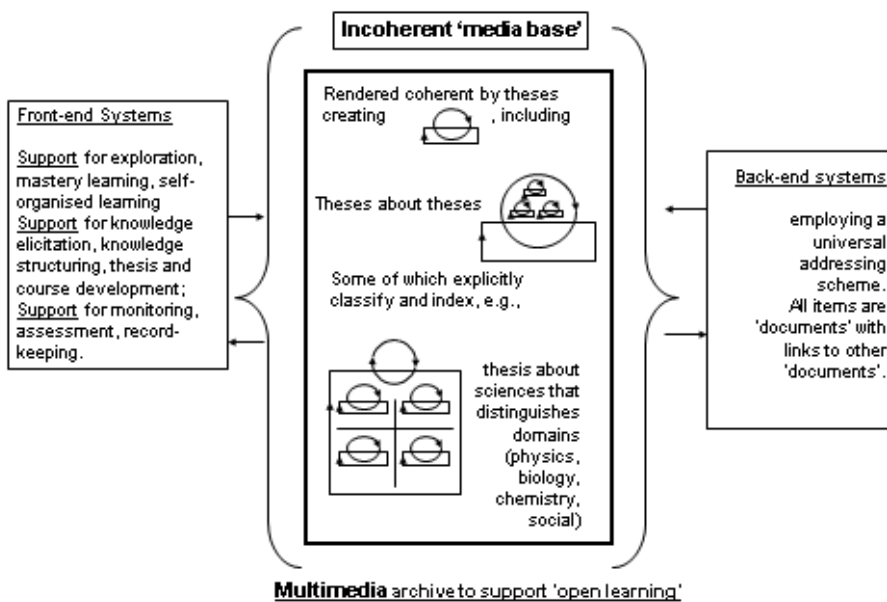


Figure 4. Towards a 'global brain' (from Scott (1993)).

These steps include projects that aim to digitise all media objects (texts, images, sound and video files) and the creation of algorithms^{1 4} for systems that: search, data mine, translate, recommend, advise, analyse, filter, amplify, schedule, regulate, manage, connect, control industrial processes, empower robots, expert systems and intelligent tutoring systems, and abstract 'meaning' from corpuses of text using forms of 'cluster analysis' that use tagging, key words and the co-occurrence of words and phrases to produce synopses.

6. Concluding comments

Whether our context is global or local, technology mediated or face to face, we are continuously sending and receiving 'messages'. As Gregory Bateson (op. cit.) puts it, as a participant in a social

system “One cannot not communicate.” It behoves us, then, to take responsibility for the messages we ‘transmit and receive’. What are our goals? How effective are we being in achieving them?

With HG Wells^{1 5} and many, many other great thinkers, I submit that education remains a priority. Too many minds are enchained by dogmatic belief systems. Too many of us have ‘business as usual’ attitudes and behaviours, in which the challenges of our times and the magic and mystery of being alive is trivialised^{1 6}.

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¹ The way in which I make this distinction is influenced by a paper by Ranulph Glanville (Glanville, 1997).

² Introductions to Pask's work can be found in Scott (2001a, 2009a).

³ For detailed (and classic) discussions of these issues see Cherry (1966) or Pierce (1980).

⁴ It is worth noting that Pask's concept of a conversation is compatible with Niklas Luhmann's (1995) concept of an 'interaction system'. Similarities and differences between the theories of Pask and Luhmann are explored in Scott (2010).

⁵ In some earlier publications, Pask uses the term 'mentation' to refer to these processes. See Pask (2011).

⁶ Pask acknowledges his longstanding indebtedness to Vygotsky in his final paper, Pask (1996).

⁷ Grice goes on to state a set of maxims to be followed if the cooperative principle is accepted: Make your contribution as informative as is required (for the current purposes of the exchange). Do not make your contribution more informative than is required. Do not say what you believe to be false. Do not say that for which you lack adequate evidence. Avoid obscurity of expression. Avoid ambiguity. Be brief (avoid unnecessary prolixity). Be orderly.

⁸ For the sake of brevity, I have paraphrased Granville's statements and omitted some of his elaborations. I have done this for both sets of requirements.

⁹ For a discussion of these pathologies and the forms they take in social organisations, see Scott (1997).

¹⁰ A non-technical account of the development of conversation theory can be found in Scott (1993). A discussion of conversation theory's relevance for educational technology can be found in Scott (2001).

¹¹ Here, 'effective' means serving as a support for learning and problem solving and is to be contrasted with efforts to produce computer programs that can pass the Turing test (https://en.wikipedia.org/?title=Turing_test, accessed 19/06/2015).

¹² For more, see https://en.wikipedia.org/?title=Recommender_system (accessed 18/06/2025).

¹³ There is a useful discussion of different conceptions of a 'global brain' here https://en.wikipedia.org/wiki/Global_brain (accessed 18/06/2015).

¹⁴ The term 'algorithm' has become a catchall for any computer programme that solves a problem. "An algorithm (pronounced Al-go-rith-um) is a procedure or formula for solving a problem. The word derives from the name of the mathematician, Mohammed ibn-Musa al-Khwarizmi, who was part of the royal court in Baghdad and who lived from about 780 to 850. A computer program can be viewed as an elaborate algorithm. In mathematics and computer science, an algorithm usually means a small procedure that solves a recurrent problem." <http://whatis.techtarget.com/definition/algorithm> (accessed 16/06/2015).

¹⁵ "Human history becomes more and more a race between education and catastrophe" (Wells, 1938).

¹⁶ I have elaborated on these themes in a number of publications. See, as examples, Scott (2009b, 2010, 2014).